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(54) Protecture container for the underground installation of tanks for pressurized, liquefied gas

(57) An improved fluid-tight, openable, protective container (1, 2, 3, 4) for the underground installation of a tank of pressurized, liquefied gas (14) with the formation of an interspace (17) between the container and the tank housed therein, in which the container has a top (3) which has a hatch (4) and is fixed removably to a peripheral wall (1) and which forms, with a connecting collar (12) of the hatch (4), a semitoroidal housing for a sealing ring (13) for separating the interspace (17) from a space inside the hatch (4), the semitoroidal housing having an outer edge (18) for bearing on the tank (14) to ensure a predetermined compression of the seal (13), an opening of predetermined depth (H1) between an inner edge (20) of the housing and the tank (14), and differentiated sealing by the seal (13) under excess pressures according to whether these develop in the interspace (17) or in the space inside the hatch (4).

The outer edge (18) has at least one radial channel which enables inspection probes to be introduced into the interspace from the hatch simply by the removal of the seal (13), without the need to remove the top (3).

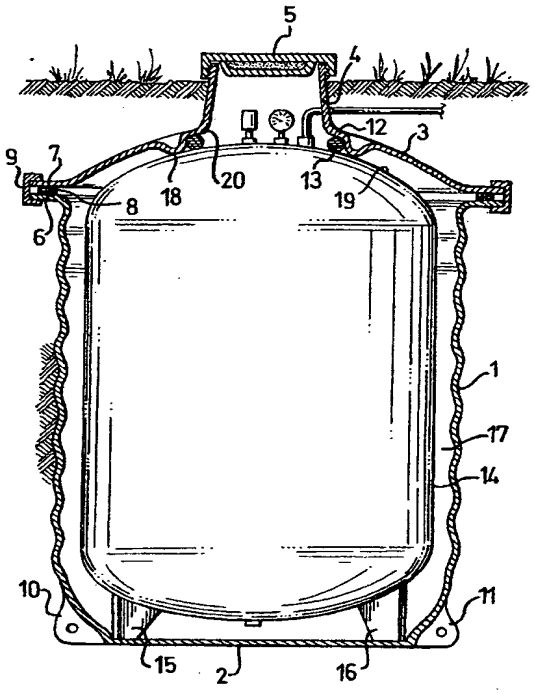

FIG.1

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magnetic, acoustic or combined inspection probe for checking at least one cylindrical arc of the tank surface and one sector of its lower closure cap which is most exposed to risks of corrosion.

Even without a full check of the tank, this partial inspection provides useful indications of the state of the tank and of its integrity and enables full checking operations with excavation and removal of the tank from the container to be deferred and spaced out over time.

Moreover, a probe for drawing off any condensation liquid which has accumulated or even a pipe for the admission of antifreeze liquid can also be introduced through the radial channel as far as the base of the container.

Furthermore, by the provision of a plurality of radial channels which extend through the outer edge of the seal housing, the inspection by probe can be extended to practically the entire outer surface of the tank and the entire internal surface of the container.

The characteristics and advantages of the invention will become clearer from the following description of a preferred embodiment and from the appended drawings, in which:

Figure 1 is an overall view, in vertical diametral section, of the underground installation of an improved protective container for a tank for pressurized, liquefied gas, according to the present invention,

Figure 2 is a perspective view of a preferred embodiment of the top and the hatch of the protective container of Figure 1,

Figure 3 is a section taken on the line I-I of Figure 2, on an enlarged scale, showing a portion of the top and the hatch of Figure 2 and its relationship with a sealing ring and with the tank of pressurized, liquefied gas,

Figure 4 is a section taken on the line II-II of Figure 2, on an enlarged scale, showing a portion of the top and the hatch of Figure 2 and its relationship with a sealing ring and with the tank of pressurized, liquefied gas,

Figure 5 is a section taken on the line III-III of Figure 4, on an enlarged scale, showing a portion of the top shown in Figure 4 and its relationship with a sealing ring and with the tank of pressurized, liquefied gas,

Figure 6 is a perspective view of a variant of the top and the hatch of the protective container of Figure 1.

With reference to Figure 1, an improved openable container according to the present invention comprises a generally cylindrical vessel formed by a peripheral wall 1, a base 2 connected to the peripheral wall 2, and a top 3 with a hatch 4 closed by a cover 5 screwed or engaged like a bayonet on the hatch 4.

The peripheral wall 1 has bellows-like toroidal corrugations of suitable depth which increase its rigidity and resistance to radial deformation relative to the axis of the cylinder of the vessel and give the wall advantageous axial resilience.

The upper edge of the peripheral wall is bent outwardly to form a flange 6 for fluid-tight coupling with the peripheral edge of the top 3, which is also bent to form a coupling flange 7.

A resilient sealing ring 8, preferably but not necessarily of rectangular cross-section, is interposed between the two flanges 6, 7.

A releasable tie 9 or other equivalent clamping means clamps the two flanges releasably, exerting a suitable pressure on the seal which hermetically seals the joint.

The base 2 has external eye bolts 10, 11 for lifting and for the anchorage of a ballast plate, not shown.

The top 3, which is generally in the form of a spherical or conical dome, is connected to the hatch 4 by means of a semi-toroidal collar 12 forming a housing for a sealing ring or O-ring 13 of circular cross-section.

The container houses a cylindrical tank 14 for pressurized, liquefied gas, disposed with its axis vertical and having feet 15, 16 for resting on the base 2, the tank preferably being spaced from the base 2, from the peripheral wall 1, and from the top 3 so that an interspace 17 is formed between the walls of the container and the tank.

The sealing ring 13 interposed between the collar 12 and the tank 14 isolates the gap from the space inside the hatch 4 and prevents the infiltration from the hatch towards the interspace of liquid or gaseous fluids and solid foreign bodies, such as dust, soil, etc., which could accidentally fall from the hatch when it is opened.

The interspace advantageously has a minimum width of the order of 4-8 cm except near the upper cap of the tank where the top 3 is bent inwardly to contact the upper cap of the tank and is then connected to the collar 12 to form a semi-toroidal housing for the positioning and outer abutment of the seal 13.

The seal, which is preferably of synthetic neoprene rubber, advantageously has a circular cross-section with a diameter of the order of 3-4 cm to provide suitable resilience and compressibility which ensure fluid-tightness.

As can be seen more clearly from the section of Figure 3, the semi-toroidal seal housing formed by the collar 12 has an outer edge 18 which is in contact with the upper cap 19 of the metal tank and an inner edge 20 connected to the hatch and spaced from the cap 19.

The maximum depth H of the semi-toroidal housing relative to the bearing surface is advantageously less than the diameter D of the cross-section of the seal so that D-H=C represents the compressive deformation applied to the seal, which corresponds univocally to a predetermined compression force exerted on the seal

greatly variable flow-rates of gas are required, it is therefore appropriate to ensure a more effective thermal exchange between the tank, the container and the surrounding soil than that ensured by conductive and convective transmission by the air in the interspace and to increase the thermal capacity and hence the thermal inertia of the system.

This can be achieved by the admission of inert liquids with high thermal conductivity and a high specific heat capacity into the interspace but, in order to avoid potential contamination of the liquid, this operation naturally has to be carried after installation, by the removal of the seal 13.

Since the compression force of the seal 13 is controlled and, in the absence of excess pressures in the hatch, has low values, the removal of the seal from its housing is extremely easy and can be carried out with the aid of a lever with a blade of suitable shape inserted between the collar 12 and the seal 13 and pivoted on the inner edge 20 of the housing as a fulcrum.

The foregoing description relates solely to a preferred embodiment but clearly there may be many variants.

For example, as shown in Figure 6, the top 3 may be constituted by a generally hemispherical or conical cap with external radial ribs having internal recesses 28, 29, 30, 31, 32, 33, 34 which extend radially from the collar 12 connecting to the hatch 4 as far as the peripheral flange 7 or a certain distance towards it.

In this embodiment, the collar 12 also forms an annular seal housing with a discontinuous outer edge which is interrupted by the cavities of the ribs and is intended to bear on the upper cap-like end of the tank. Large portions of the sectors, if not the entire sectors 36, 37, 38, 39, 40 of the top between the ribs, also bear on the tank.

The heights of the ribs advantageously decrease from the collar towards the periphery of the top in dependence on the local distance of the top from the upper cap of the tank.

The widths of the ribs may also vary, increasing from the collar towards the periphery of the top, so that each allows a wider arc and sector of the cylindrical wall of the tank and of its end caps to be investigated.

The behaviour of this top under stress is similar to that already described with the further advantage of offering greater resistance to any localized stresses exerted by the ground.

Claims

1. An improved, fluid-tight, openable, protective container of plastics material for the underground installation of a tank (14) of pressurized, liquefied gas, comprising a vessel with a generally cylindrical peripheral wall (1) closed at the bottom by a base (2) and at the top by a removable dome-shaped top (3) having a hatch (4) closed by an openable cover (5), for housing a tank (14) of liquefied gas with the formation of an interspace (17) between the container and the tank, the interspace being isolated from the space inside the hatch (4) by an annular seal (13) housed in a semitoroidal housing formed in a collar (12) connecting the top (3) and the hatch (4), the seal (13) being interposed under sealing compression between the collar (12) and the tank (14), characterized in that:
the semitoroidal housing has an outer edge (18) by which the top (3) bears on the tank (14) and an inner edge (20) which is spaced from the tank (14) and forms a calibrated opening (H1) between the inner edge (20) and the surface (19) of the tank (14) so that the seal (13) in the housing develops fluid-tightness at differentiated pressures, the pressure being higher in the case of excess pressure in the space inside the hatch (4) compared with the pressure in the interspace (17) and lower in the case of excess pressure in the interspace (17) compared with the pressure in the space inside the hatch (4).

2. A protective container according to Claim 1, in which the outer edge of the housing has at least one radial channel (21), closed by the seal (13), for communication between the interspace (17) and the space inside the hatch (4) so that an inspection and/or drainage probe can be inserted into the interspace (17) through the channel (21) solely by the removal of the seal (13), possibly even locally.

3. A protective container according to Claim 2, in which the outer edge (18) of the housing has a plurality of channels (21, 22, 23, 24, 25, 26, 27) extending radially from the collar (12).

4. A protective container according to Claim 1, in which the removable top (3) has a plurality of hollow recesses (28, 29, 30, 31, 32, 33, 34) extending radially from the collar (12) towards the periphery (7) of the top (3) which is connected to the cylindrical peripheral wall (1).

5. A protective container according to Claim 4, in which the heights of the ribs (28, ... 34) decrease from the collar (12) towards the periphery (7) of the top (3).

6. A protective container according to Claim 3, in which the widths of the ribs (28, ... 34) increase from the collar (12) towards the periphery (7) of the top (3).

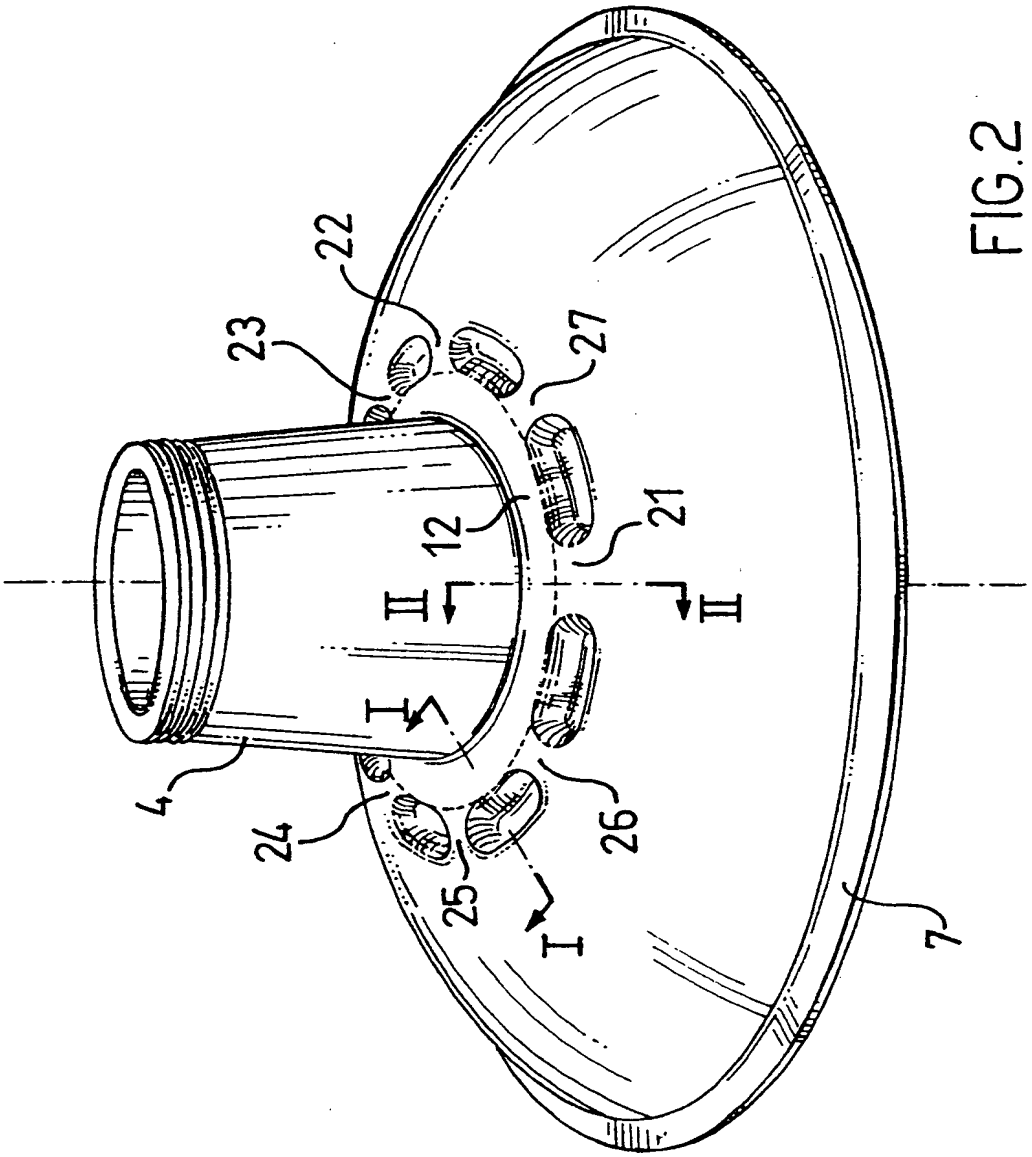

FIG.2

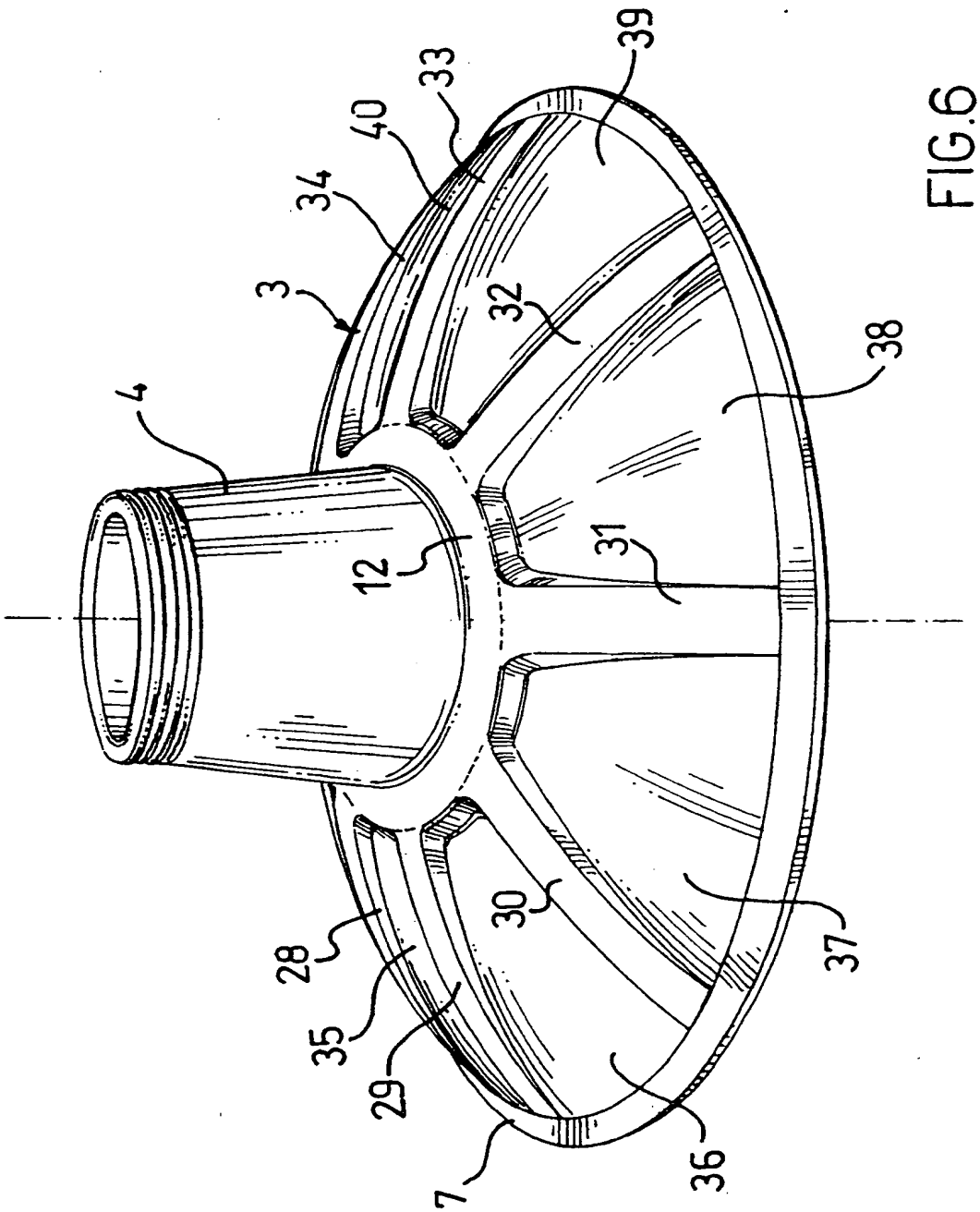

FIG.6